FOM

MAY 8, 1962

RANGER IV

FIELD OPERATIONS MEMORANDUM

JET PROPULSION LABORATORY

CALIFORNIA INSTITUTE OF TECHNOLOGY

COMPILED: [signature]

TEST DIRECTOR: Robert L. Crabtree

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I. INTRODUCTION

A. Purpose

The purpose of the FOM is to present a prompt and technically complete record of the JPL/AMR field operations. The FOM is essentially a comprehensive look at the JPL/AMR operations.

B. Scope

The scope of the FOM will be the JPL/AMR activities and events from arrival of the Spacecraft through its injection into a Lunar intercept trajectory.

The FOM composes only those operations accomplished by the Test Direction Team at JPL/ AMR. Deep Space Instrumentation Facility (DSIF) activities and the postinjection performance of the Spacecraft will be documented, respectively, in the SFOM and other Flight Evaluation Documents*.

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* Flight Evaluation Documents are listed in the Summary of Documentation Requirements for the Ranger Program EPD 11.

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II. ABSTRACT

Between the arrival of the RA-4 Spacecraft, on February 26, 1962, at the Atlantic Missile Range, until the Ranger 4 launch on April 23, 1962, all activities with respect to the Spacecraft preparation, pre-launch checkouts and final launch countdown, took place within the anticipated operations schedule.

The Ranger-RA-4/Atlas 133D/Agena 6004 vehicle was launched during the first launch countdown, meeting the first firing period, at 20h 50m 15.040s Zulu on April 23, 1962, from Complex 12 at the Atlantic Missile Range. The Atlas vehicle performed in a nominal manner and the Agena performance was well within tolerances. The spacecraft was injected into a nearly standard trajectory with AGENA-Spacecraft separation reported at Launch + 998.160 sec (21:06:53Z).

The AMR tracking and computer operation was good. The JPL Launch Checkout Station lost lock with the spacecraft transponder at L + 460 sec. At this time all spacecraft functions were indicated to be operating normally, as determined by telemetry from Antigua and the Twin Falls Victory ship. When DSIF 1 acquired the signal at Launch + 1377.96 sec., it became apparent via telemetering that the Data Encoder commutator in the spacecraft was not running.

The primary system objectives for this flight were:

1. Tracking and trajectory determination in real time.
2. Spacecraft separation devices and separation monitor.
3. Proper functioning of the following subsystems:
   a. Power
   b. Attitude Control
   c. Central Computer and Sequencer
   d. Temperature Control
   e. Structures
   f. Telecommunications and on-board data processing
   g. Mid-course Propulsion
   h. Scientific Instrumentation
   i. Lunar Capsule

This objectives were partially achieved as follows:

1. Tracking stations at Antigua, Ascension and the TFV ship acquired track on time. See Section VI, Countdown Log for details.

2. Spacecraft separation devices and monitors operated satisfactorily insofar as spacecraft - AGENA separation was achieved. Telemetry has been made available to examine the dynamics of spacecraft and AGENA moments during the separation event. Separation was normal and the AGENA retro-maneuver was normal.

3. Of the spacecraft subsystems for which telemetry was available, the following were noted:

   a. Power

      At 10 hours and 32 minutes after liftoff, the spacecraft signal was lost by the DSIF apparently because the spacecraft battery was exhausted. The spacecraft r-f signal was normal up to Launch + 10 hours 32 minutes. The expected battery life was less than 9 hours.

   b. CC&S

      A number of attempts were made to transmit commands to the spacecraft for trouble shooting purposes without success. Since the telemetry commutator, gamma-ray readouts and command decoder all depend on a 25-pulse per second signal from the CC&S, it appears that the 25-pulse per second signal was not being generated in the CC&S. Nor does it appear that any of the CC&S commands were given with the possible exception of the "transmitter power-up" command which is given before DSIF acquisition. These CC&S commands also use the 25 pps. At the time of MTS acquisition, the commutator in the spacecraft data encoder had already stopped on segments which have not yet been positively determined. No blips or any other indication of subsequent CC&S commands were observed. The received signal strength indicated that the transponder power was up during the South Africa pass. The Channel 1 400 cps did not come on as reported by DSIF at Launch + 4 hours.

4. AGENA Telemetry

Examination of AGENA Channels 10, 11, and 12 shows that the mechanical separation of the spacecraft five seconds after electrical separation was normal.

III. JPL PRE-LAUNCH OPERATIONS

A. Schedule of Operations.

Scheduled operations took place as indicated in Figure 1. The period of pre-launch operations started with the arrival of the spacecraft at AMR, and finished with the scheduled launch period.

B. Operations Summary

RA-4 Spacecraft arrived at Hangar AE the morning of February 26, 1962. After receiving inspection, it was transferred to the Assembly dolly and located in the "high-bay" area of Hangar AE. Both the flight and spare midcourse motor were removed and given to the cognizant Engineer for inspection and leak check.

1. Mechanical assembly and checkout of the Spacecraft continued through February 26 and 27, 1962. Both the omni and hi-gain antennas were inspected and sent to the antenna laboratory in Hangar AE for storage. The midcourse motor was returned from a satisfactory leak-check inspection and installed. The accelerometer was checked for calibration and installed on the Spacecraft. The vidicon and vidicon TR were installed on the Spacecraft, as well as the vidicon cable and Case II (transponder). In preparing to assemble Case II to the Spacecraft a rattle was detected. The transponder was opened and a loose coil locking nut was replaced and tightened. In addition to the above, flight gyros and gyro electronics were installed in Case IV. Final installation of all other electronic cases, a dummy radio-altimeter, retro-support, retro-motor, and lunar capsule completed the spacecraft configuration for Initial Power Turn-On. The Spacecraft was transferred from the assembly dolly to the System Test Stand for this test.

2. Wiring integrity and grounding checks were made prior to Initial Power Turn-On the morning of February 28, 1962. Ground checks of the GSE and System Test Area were performed and minor ground changes were made to conform to standard grounding procedure. No unknown grounds were found looking back into the spacecraft. During the Initial Power-On checks, the following were noted:

   a. Attitude Control GSE had a gyro meter sensitivity change which was at first thought to be a gyro problem. The sensitivity was higher, by a factor of 10, than the GSE at Pasadena.

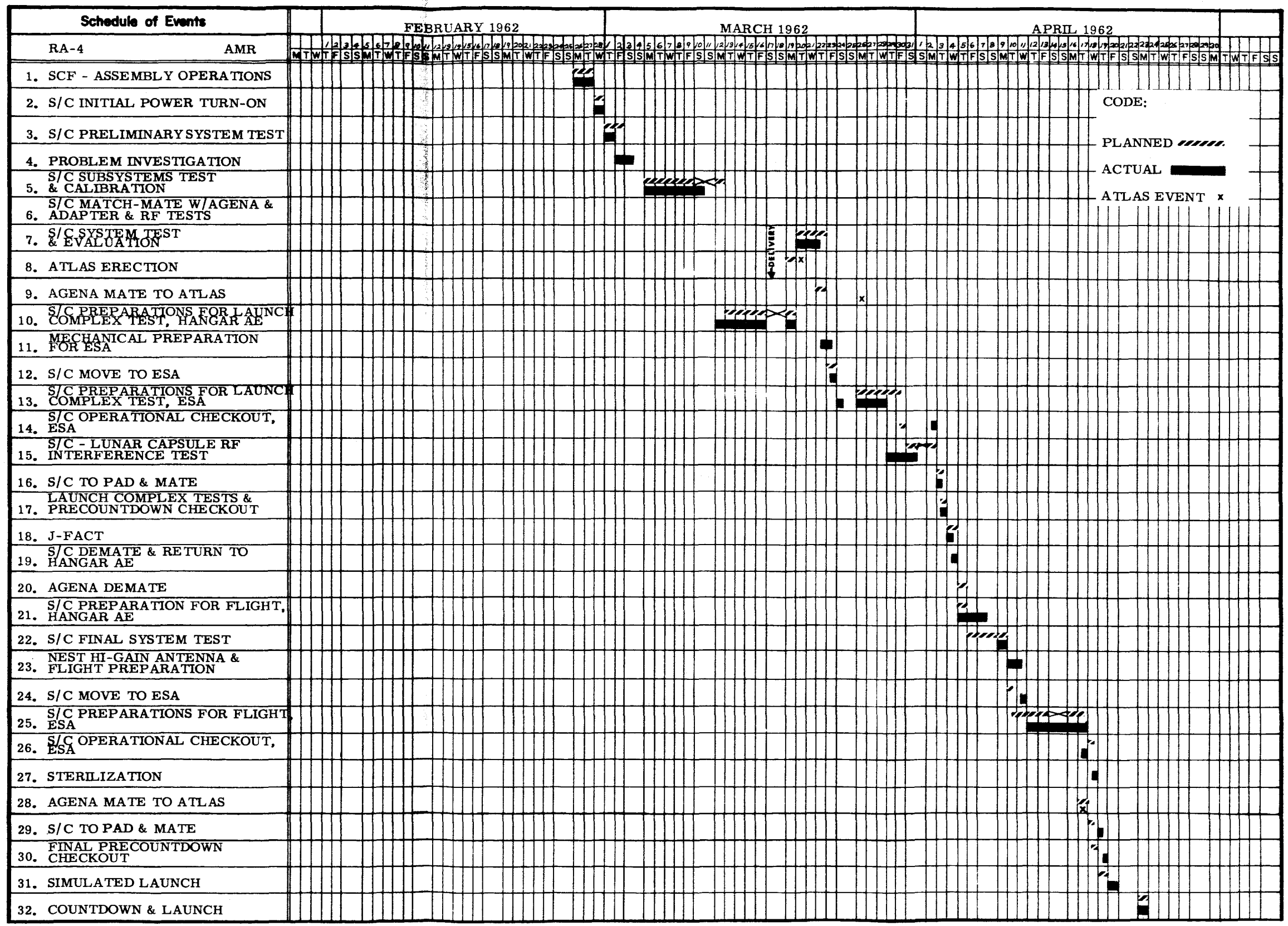

Figure 1. RA-4 OPERATIONS SCHEDULE.

b. Power GSE had a deck selector switch on the scope monitor that was a make-before-break type. It should have been a break-before-make type, and during the test 26v ac was momentarily connected to the -9 v dc in the Spacecraft. The switch was disabled and no Spacecraft damage occurred.

c. Scientific 4 v dc was missing on telemetry and on the Power GSE Monitor light. The trouble was in a connector (9W1P2) external to the Spacecraft. The cable was replaced.

A complete power survey was satisfactorily accomplished.

3. System Test No. 1 was performed on Ranger 4 Spacecraft on March 1, 1962. Subsystems experiencing difficulties were:

Communications

A weak battery and a noisy crystal in the communications GSE caused loss of 960 mc lock several times between the spacecraft transponder and the GSE receiver.

Attitude Control

The GSE counter failed, and a plus Yaw primary Sun Sensor switch was inoperative. Checking revealed a loose connection external to the spacecraft.

Central Computer and Sequencer

A faulty GSE preset counter sensitivity adjustment caused several counts to be lost during fast counting to a preset value.

Power

GSE noted a momentary out-of-tolerance indication of the Attitude Control single-phase inverter when CC&S command A-4 was initiated; an out-of-tolerance condition was noted in the Scientific 26 v dc power on the analog voltage scanner. These were all isolated in the GSE.

Data Encoder

A spurious B2 event (1110) was received 40 seconds after the first pitch maneuver near the end of the system test. It was investigated without success on the records, but may have been due to the loosening of the Lunar Capsule separation switch simultaneously with the indicated event.

Telemetry Evaluation

What proved to be a chronic problem occurred at C + 64 minutes during the terminal phase of the test when a mode change took place at Radio/Altimeter Turn-On. The Mode change was noted on telemetry during simulated squib firing when the fuse load was blown. Investigation of the source of this transient was done on March 2nd and 3rd, which revealed the following:

a. The pulse measured at the Data Encoder input from the CC&S was repeatable at about 3-4 volts when the fuse load fired.

b. The pulse was coupled from the battery line in the squib firing assembly or from Case VI into lines between the squib firing assembly and the CC&S.

c. The pulse was coupled in the CC&S into the mode change circuitry and appeared at the input to the Data Encoder mode change module, 6A14.

Verification of the transient on the PTM at JPL-Pasadena was done, and the results checked on the RA-4 Spacecraft at AMR. The problem was inherent in the test-set-up, in which the squib firing (fuse load) circuit was connected to the external battery with very long leads. This condition coupled the transient to vulnerable circuits throughout the spacecraft. When the battery was installed in the spacecraft the coupling disappeared as did the transient which caused the mode change.

4. Telemetry Calibrations took place March 5th through March 7, 1962, as indicated:

4. Telemetry Calibrations (Continued)

Channel No.	Measurement
3F0	-X Panel (4A10) volts
3F1	+X Panel (4A9) volts
4H4	Power 400 cps one Phase Inverter Volts
4E0	Low-Gain Antenna Drive
4E1	High-Gain Antenna Drive
4J0	Earth Sensor Temperature
4J4	Battery Temperature
2G5	Nitrogen Tank Temperature
4E4	Transponder High Voltage Supply
3D2	Receiver Phase Error (Coarse)
4E5	Receiver Phase Error (Fine)

5. Match-Mate with the spacecraft shroud and adapter was accomplished March 8, 1962, without difficulty.

6. Spacecraft RF Losses in launch configuration were measured using both low and hi-gain antenna systems after the omni-antenna coupler was adjusted to the spacecraft flight shroud on March 9, 1962.

7. Miscellaneous Calibrations (March 10, 1962). Telemetry Channel 4E2, Transponder RF drive, was calibrated. Channel 2D0, Midcourse Motor Chamber Temperature was adjusted to mid-band frequency. It was necessary to replace Attitude Control, 400 cps single phase inverter module 4A13 (S/N 9) with module (S/N 6) due to a waveform distortion that appeared when A-4 was set. The Gamma-Ray high voltage power supply, 23A2 (S/N 5) was replaced by power supply (S/N 3) since it was a less temperature-sensitive unit. During calibration of the Radio/Altimeter (S/N 2 and S/N 4), the latter unit was rejected by the cognizant scientist as being below flight acceptance quality. Radio/Altimeter (S/N 4), however, was found to be the only unit compatible with its support structure. In addition, the altimeter would not normally deploy until the shroud bumper was removed. A retro-fit and mechanical adjustment solved both problems.

8. Mechanical Disassembly and Inspection of RA-4 Spacecraft. The week from March 12 through March 17, 1962, was spent in making a complete mechanical inspection of all subassembly units on Spacecraft RA-4, and making microscopic examination of all RA-4 modules. The results of these quality control inspections follows:

Unit	S/N	Problem	Disposition
7A4	6	Chipped paint on diode	Reworked to Flight Acceptance Quality
4A8	6*	Ruptured Capacitor	Replaced with S/N 7
23A7	5	Chipped paint on 2 diodes	Reworked to Flight Acceptance Quality
23A6	5	Chipped paint on diode Solder splash on resistor	Reworked to Flight Acceptance Quality
23A5	5	Bad solder connection	Reworked to Flight Quality
8A41	6	Potting compound on Module Temperature Surface	Reworked to Flight Quality
4A14	7	Bad solder connection	Reworked to Flight Quality
4A3	7	Chipped paint on diode	Reworked to Flight Quality
6A4	4	Chipped paint on diode	Reworked to Flight Quality
6A12	4*	Chipped diode	Replaced by S/N 5
4A5	9	Twelve resistors had cracks in potting material	No rework - Accepted Flight
4A12	3	Three resistors had cracks in potting Material	No rework - Accepted Flight
4A6	4	Solder splash on resistor	Reworked to Flight Acceptance Quality

* Failure reports issued on these modules

9. Attitude Control System leak-checks performed on March 12, 1962, showed that the new pressure transducer (S/N 1632) installed had an OPEN at about 1790 ohms. Since the Attitude Control Gas System revealed no leaks, the transducer was flight-accepted pending further monitoring.

10. ECO 2603

Both Gamma-Ray Boom Harness (9W17, S/N 10) and Gamma-Ray TR (23A7, S/N 105) were modified as per ECO 2603. This ECO called out the installation of a temperature transducer inside the Gamma-Ray Sphere.

11. ECO 2403

Holes were drilled in the spacecraft structure and nut plates added as per ECO 2403. This was to accommodate the possible installation of a spin stabilizer to assure capsule spin stabilization before complete separation of the capsule, from the spacecraft.

12. ECO 2127

The temperature transducer was electrically disconnected on the mid-course motor and the lead tied back per ECO 2127. This was necessary because of high temperature breakdown in the transducer lead noticed during the RA-3 flight.

13. Antenna drive Electronics (7A3)

Antenna drive electronics S/N 6 was replaced by S/N 8. S/N 6 was carried as a spare only, as it was near the tolerance limits of the roll search limit cycle and had low acquisition signal gain.

14. Telemetry calibrations.

The change in Data Encoder 6A12 module, S/N 4 for S/N 5 and finally to S/N 6 because of noisy potentiometers in S/N 5, necessitated the recalibration of nine (9) temperature measurements and gyro measurements. The Attitude Control Nitrogen Tank Pressure measurement was calibated. It was again verified that the transducer is open at 2296 psig. These calibrations were completed March 19, 1962, in preparation for System Test No. 2 at AMR.

15. System Test No. 2 (AMR)

The System Test was performed on RA-4 spacecraft on March 20, 1962. All spacecraft subsystems operated normally in all respects, with only minor GSE problems noted. The C + 64

mode change problem noted during System Test No. 1 (AMR) was not observed with the use of a flight-type battery in Case VI. Investigation of the following discrepancies were carried out:

a. CC&S

The preset counter in the GSE was still not performing reliably and resulted in uncertainty in CC&S event times.

b. Communications

An apparent Static Phase Error discrepancy in the communications transponder was resolved to be because of using a wrong calibration curve. The GSE ground transmitter was still noisy.

c. Attitude Control System

The system appeared to perform properly during the system test, however, close examination of the data on the next day revealed a shift in the fixed gyro torque voltages measured at the GSE. The problem was intermittent as it was still apparent on March 21, but was not noted in the afternoon of the 21st or the morning of the 22nd. The problem was noted only after CC&S command A-3 was set. The following tabulation of data illustrates the differences noted between System Test No. 1 and System Test No. 2.

	System Test No. 1		System Test No. 2	
	Prior to A-3	After A-3	Prior to A-3	After A-3
Yaw	+ 290 mv	+ 140 mv	+ 290 mv	+ 207 mv
Pitch	+ 235 mv	+ 110 mv	+ 235 mv	+ 70 mv
Roll	- 40 mv	+ 65 mv	- 36 mv	+ 80 mv

The Attitude Control System (Case IV) was removed from the spacecraft on March 23, 1962, and the spare case installed for the ESA and J-FACT activities.

d. The C + 64 mode change problem was investigated in detail at Pasadena on the PTM. It was determined to be a coupling problem, the fix checked out at JPL, Pasadena. The fix was a filter modification to the Squib Firing Assembly battery line to CC&S. The problem was examined on RA-4 at AMR with a flight type battery installed in Case VI, and with a simulated thermal relay load. The critical

point examined was the input to Data Encoder mode change module. Thirteen fuses were blown and two sets of thermal relays. No pulses of any measureable amplitude were seen at the Data Encoder input. The investigation was halted based upon the conclusion that if a flight-type battery had been used for all system tests the problem would never have occurred. The high pulse currents in the long battery leads caused the problem. The problem was considered to be resolved.

e. The Flight Solar Panels were connected to the spacecraft and the following checks performed:

1). Shunt diode current checks.

2). Solar cell experiment loop check.

3). Secondary sun sensor check.

4). Solar panel temperature transducer check.

The only difficulty noted in any of these checks was an 8 degrees F. discrepancy in one of the temperature transducers. Temperature transducer S/N 737 was replaced with S/N 570.

f. The vidicon light sensitivity was adjusted for the third day of the available six-day firing period.

16. Power Overload Adjustment - March 22, 1962.

a. All of the power system modules which have overload protection were checked and adjusted. The final settings were tabulated:

	Power System	Overload Setting (ma.)
4A6	CC&S Inverter	725
4A4	Communications Converter	1030
4A5	Command Converter	320
4A7	Data Encoder Converter	960
4A8	Scientific Inverter	555
4A13	400 cps, 1 phase Inverter	420
4A3	Attitude Control Converter	2050

b. Data Encoder Channel 2G2 (Solar Panel Temperature) was recalibrated because of a transducer failure and re-replacement on March 21, 1962.

c. Mechanical

Final Pre-Flight Evaluation of the Squib Firing Assembly prior to moving the Explosive Safe Area (ESA) was also completed on March 22, 1962. Mechanical preparations for the move to ESA included:

1). Transfer of the spacecraft from the System Test Stand to the Assembly Dolly.

2). Removal of dummy retro-motor and match-mate between the spacecraft and retro-support structure, S/N 103, and altimeter support structure, S/N 2.

3). Removal of Earth Sensor, and reinstallation on yoke.

4). Installation of high-gain antenna, with J-FACT-type antenna yoke.

5). Installation of spin motor restrainer nut plates.

6). Securing of Gamma-Ray cable for transport of spacecraft.

7). Mid-course motor alignment.

8). Covering spacecraft with shipping bag, loading with dessicant, and covering with the transporter shipping dome.

All mechanical assemblies were properly fitted except for a slight interference between the omni squib cable and the fiberglass liner. The interfering portion was cut away.

The spacecraft was moved from Hangar AE, and escorted to the Assembly and Sterilization Laboratory at the ESA on March 23, 1962, and moved into the quonset hut.

17. Final Assembly and Pre-Flight Preparation, took place in the Assembly and Sterilization Laboratory at the ESA from March 26 through March 28, 1962. The following operations were completed:

1). Altimeter and support structure mounted.

2). Assembly of dummy retro-motor, flight spare retro-motor support and electrical equivalent of Lunar Capsule to spacecraft completed.

3). Omni-antenna and boom assembled to spacecraft.

4). Dummy solar panels installed on spacecraft.

5). Spacecraft mated to AGENA adapter.

6). Omni-antenna shroud coupler adjusted.

7). Final pyrotechnic and battery checkout performed.

8). Installation of non-flight thermal radiation shield.

9). All solar panel and omni pin pullers were installed with burn-wires instead of live squibs.

10). Electrical checkout performed per JPL Proeedure P35R 315.02.

In addition, the Attitude Control Case IV, was returned to JPL at Pasadena for investigation of abnormal fixed gyro torquer current noted during System Test No. 2 (AMR). After evaluation by the Cognizant Engineer, these gyro torquer currents were stated to be out of tolerance.

18. RF Interference Tests between the spacecraft and Lunar Capsule electrical equivalent were performed on March 29, 1962. No RF interference was noted between the Lunar Capsule and the Spacecraft receiver with the shroud off, but a four (4) dbm degradation was noted at the spacecraft, the receiver AGC threshold at -136 dbm with the shroud on.

All RF interference checks between spacecraft transponder receiver and Lunar Capsules were made in the following manner:

Test 1 (Hardline to Case II)	The ESA roof antenna was connected directly to the omni cavity output at Case II. The capsule was transmitting but had no effect on receiver AGC.

18. RF Interference Tests (Continued)

Test 2 (Shroud OFF) - The ESA roof antenna was connected to an omni probe or a Stoddard dipole about six inches from the omni-antenna. The omni-antenna was connected to Case II and the Lunar Capsule was transmitting.

Test 3 (Shroud ON) - The ESA roof antenna was connected to the quick disconnect on the shroud. The shroud was on the adapter and all spacecraft connections as in Test 2.

The roof antenna was used to send the spacecraft mixed signal back to the Launch Checkout Trailer where it was received, recorded and sent to Hangar AE via hard line for evaluation. The AGC measurements were taken from telemetry on 10-second counts to provide the accuracy desired.

Table 1. AGC THRESHOLD MEASUREMENTS.

		AGC Threshold (dbm)			Capsule
Date	Lunar Capsule	Test 1	Test 2	Test 3	Freq. (mc)
March 29	Elec. Equivalent	-140	-140	-136	960.150
March 30	S/N 13 (Flight)	-140	-139	-136	960.250
March 31	S/N 14 (Spare)	-140	-132	-110	960.150

19. Operational Checkout of the Spacecraft in the ESA was accomplished on April 2, 1962.

a. Evaluation

The only difficulty noted during the test was that the Lunar Capsule electrical equivalent was found to degrade the transponder receiver threshold to -117 dbm. Under the same spacecraft conditions on March 29, 1962, the threshold was -136 dbm. Explanations for a change of this magnitude were:

1). The capsule electrical equivalent had been taken apart to shave 0.1 inch off the center to make this capsule equivalent to the flight units and during reassembly the transmitter could have been installed 180 degrees from its position March 29th.

a. Evaluation (Continued)

2). The spectrum of the capsule could have changed. This capsule was returned to JPL, Pasadena for evaluation.

b. Complex 12 On-Pad Checks with the spacecraft simulator.

The problems noted were:

1). The umbilical plug could not be "cocked". Another had been designated for the RA-4 flight.

2). The TEST COMPLETE light on the power GSE in the Blockhouse would not light.

20. Spacecraft Mate to AGENA. (April 3, 1962.)

The RA-4 spacecraft was prepared for moving to Complex 12 by purging with N_2 and sealing the shroud at RH of 5 percent. On April 3, 1962, the spacecraft was moved to Complex 12, and mated to the AGENA at the 14th level of the gantry. Match-mate to the AGENA was not to flight-acceptable standards due to out-of-tolerance shims. They were removed, and mating accomplished without shims, but retro-fitting was done after the J-FACT.

21. AMR Precountdown (April 3, 1962.)

The following were noted:

a. An 11.9 db repeatable loss was measured between the quick disconnect and the output of the slot-antenna (HAT) coupler.

b. Spacecraft TRANSPONDER RECEIVER threshold was measured to be minus 118 dbm with the Lunar Capsule transmitting.

c. The antenna system was transferred to the high-gain antenna and the transponder receiver threshold was -140 dbm with the Lunar Capsule transmitting.

d. The spacecraft cooling blanket was blown off by air conditioning flow (70 lbs/sec. at 40° F.) late during the test. The last hour of the test was performed without air-conditioning since temperature control is not critical except when "live" retro and mid-course motors are installed. The problem is believed to be caused by age on the blanket and since a new blanket was to be used for the countdown, no difficulty was expected.

21. AMR Precountdown (Continued)

e. Communications reported that the Mode IV spectrum was difficult to verify because the Radio Altimeter mock-up was not terminated.

f. The fuel tank pressure transducer was determined to be defective.

22. Joint Flight Acceptance Composite Test (J-FACT, Test 1947).

J-FACT JPL portion was performed on April 4, 1962, using JPL Procedure 307.01-1, dated 4 April, 1962 (Launch Plan 23G).

Operation was normal; the count progressed with no exceptions until T-4 seconds.

A HOLD was called at T-4 seconds by G.E. Guidance/ Burroughs because of an automatic cutoff indication. The count was recycled to T-5 minutes and held. After discussion, it was believed to be a normal indication for the procedural conditions peculiar to the J-FACT operation.

The count was resumed at T-5 minutes, with T-0 occurring at 1631:30Z (approximately). A hold was called at T-0 by GD/A, however only after the JPL umbilical had been removed. This hold was again called for the same reason, (automatic cutoff indication).

The count was recycled to T-5 minutes and the spacecraft umbilical was left out, at the request of JPL. The spacecraft operated through the T-minus count until T + 25 minutes. The spacecraft umbilical was reinstalled at T + 25 minutes and the spacecraft was switched back to external power and shut down at 1659Z.

The range count recycled to T-25 minutes and held because of another Range operation.

The count was finally resumed at T-25 minutes at 2015Z. At T-15 minutes a hold was called to allow completion of Range Safety checks. Time was picked up at T-15 minutes at 2035Z. During the "built-in" hold at T-5 minutes it was noted that the spacecraft was not operating correctly. The problem was with data encoder/telemetry and was believed to be a malfunction in Case 5 i.e., that the rate limiter may be faulty. Although this would be an unacceptable condition for launch, it was decided to continue the J-FACT.

22. Joint Flight Acceptance Composite Test (Continued)

The count was resumed at T + 5 minutes at 2054Z. LMSC requested permission to eject the spacecraft umbilical at T + 10 seconds as a precaution in the event of another last-minute hold.

T-0 occurred at 2100Z. (The SRO reported first motion at 21:00:19.151Z.)

The spacecraft umbilical was reconnected at T + 24 minutes, and the spacecraft switched to external power and shut down at 2129Z.

The earlier trouble with the automatic cutoff indication was found to be caused by two open leads from the vernier engines. The lines had been severed in a cabinet door. The spacecraft was demated and returned to the SCF (Hangar AE).

Table 2. J-FACT LOG

T-Time	Z-Time	Event
-	-	Countdown initiated on J-FACT.
-	-	HOLD - G.E. Guidance, automatic cutoff indication. Recycle to T-5 minutes.
T-5m	-	Resume count.
T-0	1626	HOLD - G.E. Guidance, automatic cutoff indication. All umbilicals ejected. Recycle to T-5 minutes and vehicle umbilicals reinstalled. Spacecraft umbilical left out until T+25 minutes.
-	1659	Spacecraft power off.
-	-	Count recycled to T-25 minutes, and holding. Higher priority Range operation.
T-25m.	2015	Resume Count.
T-15m.	2025	HOLD - RSC checks not completed.
T-15m.	2035	Resume Count.
T-5m.	2045	Built-in hold.

TABLE 2. J-FACT LOG (Continued)

T-Time	Z-Time	Event
T-0	21:00:19.151	Simulated lift-off.
T+24m.	2124	Spacecraft umbilical reinstalled.
-	2125	Spacecraft switched to external power.
-	2129	Spacecraft power off.

23. Problem Investigation and Calibrations (April 5,6,7, 1962).

The following inspection, mechanical changes and investigations were carried out prior to the final establishment of the spacecraft configuration for flight:

a. Inspection of the transducer on the fuel tank of the mid-course motor verified that the transducer was open. Transducer S/N 8506 had failed and was replaced with S/N 8503.

b. Radio Altimeter Support Structure, S/N 103, was checked for fit to the spacecraft. This was the new design of support structure which included the spring for more positive deployment. Everything fit properly.

c. Final inspection of the vidicon optics showed that a mechanical interference problem existed between an antenna support and the vidicon shade. ECO 3862 was approved, allowing removal of a small amount of material from the shade, to prevent interference.

d. Attitude Control Fixed Gyro Torque. In attempting to isolate the problem several checks were made on the spacecraft wiring:

1). Impedance checks looking into Data Encoder and CC&S cases through the ring harness.

2). Continuity checks on certain lines through the ring harness.

3). Megger checks on the ring harness with Data Encoder and CC&S disconnected.

4). Megger checks of the system test complex cabling from the spacecraft to the Attitude Control GSE.

23. Problem Investigation and Calibrations (Continued)

No problems were indicated and Case IV was then reassembled to the spacecraft.

e. Case VI was weighed (38 lbs. 5-1/2 oz.) and assembled to the spacecraft. This included the flight battery, S/N 14 and temperature transducer, S/N 791.

f. Holes were again drilled in the spacecraft "bus" per revised ECO 2403.

g. Lunar Capsule S/N 14, a questionable spare unit, due to RF interference, was sent to JPL, Pasadena, for clocking tests and evaluation. The electrical equivalent capsule was also returned to JPL, Pasadena.

h. ECO-508. The flight co-axial connectors for the omni and high-gain antenna system were removed from the spacecraft to perform the change. This ECO covers potting the connector to the cable with Epon 815 after removing the back locking nut, potting, and replacing the nut. This is necessary because of teflon cold flow causing the connector to loosen on the cable.

i. The Gamma-Ray Detector and high voltage power supply was removed from the test boom and installed in flight boom, S/N 9. The Gamma-Ray detector and boom were then assembled to the spacecraft. The Gamma-Ray Spectrometer had been updated the previous night with ECO 4401. This ECO, which supersedes ECO 3155, provides for the addition of a transistor and associated components to block the reject signal in one gain mode.

j. Tests and Calibations. After the spacecraft was assembled to the system test fixture, the following checks were made:

1). Extra pulses seen on Central Recorder CC&S IPP lines were found to be generated by noise from an oven heater in the CC&S GSE. The heater was disconnected from the power line and the problem disappeared.

2). The mid-course fuel tank pressure transducer was calibrated with the telemetry system.

3). It was determined that the nonlinear ramp on Channel 4E6 was due to noise from Power Switching and Logic-module, S/N 4. It was replaced with unit S/N 7, eliminating the noise and suspected non-linearity. A failure report was initiated.

j. Tests and Calibrations (Continued)

4). In a continuing effort to determine the cause of the Attitude Control gyro fixed torque problem, the gyros were mounted to a rate table and powered from the spacecraft. Different gyro headings were made and gyro outputs were measured with CC&S Command A-3 both ON and OFF.

5). The Solar Panels were cleaned for flight.

6). As a result of the Power Switching and Logic module change April 6, 1962, it was necessary to recalibrate the following channels:

(a). Power System Voltage - $3D_2 8$.

(b). Power System Current - 3F7.

(c). Plus X Panel Amperage- 4E6.

(d). Minus X Panel Amperage - 4E7.

(e). PS&L Temperature - 4J6.

7). Communications system threshold checks verified an AGC threshold of -138 dbm, with the newly calibrated Ground Transmitter.

8). A power survey was completed satisfactorily (flight battery reading 25.56 v).

k. Follow-Up Testing.

1). A Gamma-Ray check was performed. It was determined that the gain had shifted 6 percent from the bench check made the morning of April 5, 1962. The sphere was opened and the gain was adjusted.

2). During the investigation on the Attitude Control gyro fixed torque problem, it was found that the gyro rate voltages, measured at the GSE, were somewhat dependent upon the position of the jet vanes after A-3 was set. A full report on the phenomena observed will be forthcoming from the Attitude Control group.

3). During a check of the Vidicon, when Command RTC-6 was sent to turn on Vidicon power, the Scientific inverter went into a three-second overload. A normal condition, it was because of the high initial current drain of the Vidicon and not detrimental to either system.

k. Follow-up Testing (Continued)

4). Match-Mate of Spin Motor Restrainer.

The Spin Motor restaining device which arrived at AMR on April 7, 1962, was match-mated to the spacecraft.

24. Final System Test at AMR (System Test No. 3)

The test was performed on RA-4 spacecraft on April 9, 1962.

a. The test proceeded normally thru Step 26 (JPL Procedure 300.04) when the test was interrupted to replace a faulty Battery Temperature Transducer. Unit (S/N 791) was removed and replaced with unit (S/N 626) and Data Encoder recalibrated battery temperature Channel 4J4. The final System Test continued without serious difficulty,except for the above noted transducer failure and two irregular operational malfunctions, finishing about 2100 hours EST.

b. The two operational malfunctions noted, and subsequently confirmed were:

1). The B2 events noted during the Final System Test all occurred in coincidence with turn-off of the Gamma-Ray recorder paper drive. This was verified during the test, and after the test it was observed that upon Scientific-GSE switch actuation, 3 volts p-p noise was present between the D/E telemetry return and the spacecraft frame, measured at the direct access connector to the Gamma-Ray.

2). The CLEAR command (RTC-0) observed midway during the test, prior to the end of Launch Phase (section II), was apparently caused by RWV being switched to a test mode without first depressing the error button. This condition was simulated, and quite reliably caused an RTC-0 command to the spacecraft which was correlated after the test with a frequency shift actually observed at the Communications Modulator in the GSE.

There were no other problems associated with the RA-4 spacecraft, and all subsystem representatives reported that their subsystems were in a flight-ready (GREEN) condition. Minor GSE problems were all that remained to be solved.

c. System Test Evaluation:

1). On April 10, 1962, during the evaluation of the Final System Test, the Solar Panel Current fluctuations noted on Channel 4E6 were isolated to a relay in the solar panel simulator power supply. Dirty contacts were found to be the cause of the noise, and the relay was replaced.

2). A high radioactive background count at the spacecraft was verified the night of April 10, 1962, when the surrounding areas were mapped with the spacecraft Z-axis vertical. The source responsible for the high count was isolated to Attitude Control Case IV, in the area in which the accelerometer is installed. It was later determined that there is in fact a radioactive source built into the accelerometer by design. Other differences noted in the background count rate were due to Case IV being open during test, thereby changing the apparent location of the radioactive source.

The complete story on the degree of degradation to the Gamma-Ray experiment is beyond the scope of this report. It is recommended that this information be published by the Gamma-Ray cognizant personnel.

3). Final evaluation of the gyro fixed torque current problem (Attitude Control) noted during System Test No. 2 was made. It was determined that this condition would not affect spacecraft mission performance. The condition was traced to a feedback by the jet vane position signal from the accelerometer summing junction to the gyro amplifier loop. Normally in the zero position, they were not so located during System Test No. 2.

25. High-gain Antenna Nesting and Preparation for Move to ESA (April 10 and 11, 1962).

In preparation for moving the spacecraft to the Explosive Safe Area, the following operations were performed:

a. Flight yoke installed.

b. Earth sensor installed and aligned.

25. High-gain Antenna Nesting and Preparation for Move to ESA (Continued)

c. All external surfaces cleaned.

d. High-gain antenna nested and Scientific power checks made.

e. Installed pin-pullers and fitted solar panels.

f. Mid-course motor was removed from the spacecraft and taken to ESA for fueling and leak checks.

g. The thermal shield was again installed on the Vidicon experiment and the impedence to ground verified.

The spacecraft was transported to ESA at 2300 hours EST, April 11, 1962.

26. Explosive Safe Area, Activities April 12, 13, 14, 1962.

Following Final System Test evaluation, the spacecraft was released to move to the Explosive Safe Area for final preparations for flight.

a. The following operations were performed during the ESA operations: (April 12, 1962.)

1). No voltage and grounding checks performed before squib firing assembly installation.

2). Mid-course motor installed and aligned.

3). Radio-altimeter mounting and flight accepted retro support installed.

4). Aft heat shield and fuel tank protective cover installed.

5). Leak check made on antenna gear box (24-hour rate: 0.1-pound gauge).

(April 13, 1962.)

6). Lunar Capsule Assembly (S/N 13) mated to retro-support structure, after verification of balance, and verification of sensor separation switch.

7). Omni-antenna boom installed.

8). Solar panel temperature transducers checked.

b. Lunar Capsule (S/N 13) was checked for RF interference with the spacecraft transponder operating and in "shroud off" condition. Test was run

according to JPL Procedure 328.00-1. AGC threshold (Part 1) reported -142 dbm LC OFF, TRANSPONDER ON. AGC threshold (Part 2) reported -138 dbm LC ON, Shroud OFF. AGC threshold (Part 1, re-check) reported -140 dbm. A 2-db degradation was considered acceptable.

c. ESA operations continued on April 14, 1962 as follows:

1). Flight accepted solar panels installed.

2). Sterilization of the antenna gear box with ethylene oxide was accomplished.

(April 15, 1962.)

3). Leak-checked fuel and oxidizer tank on mid-course motor; reported zero leak rate.

4). Radio-altimeter battery replaced, R/A again installed.

5). Antenna gear box purged and pressurized with dry Nitrogen to 20 psi.

(April 16, 1962.)

6). Nitrogen Attitude Control System gas pressurized to 3525 psi at 70° F.

7). Omni-antenna installed.

8). After weighing spacecraft, it was mated to AGENA 6004 adapter (adjustment necessary at foot D and at Foot C).

9). Spinoff pyrotechnics installed and safety wired.

10). Squib from puller (S/N 702) was replaced in puller S/N 758.

d. ESA Operations Continued on April 17, 1962.

1). Mated spacecraft to LMSC adapter 6004.

2). Spacecraft battery cell voltages were recorded. All were within tolerance.

3). Adjusted omni antenna coupler in the shroud. Final clearance between omni and coupler was 0.432 inches.

4). The shroud liner had to be pushed in slightly so that the liner would not touch the antenna gear box coffin cloth. This should be checked for future spacecrafts.

5). In performing the final JPL and ADF ordnance checks two problems were noted:

a). One bolt cutter on the Altimeter support structure which gets an electrical signal through finger contacts had an out-of-tolerance resistance.

b). During bridge to ground checks 8 SQ 3 read 20 K ohms to ground. This is below tolerance and the squib was changed in the pin puller. A failure report was initiated. The fingers were repositioned to correct tolerance.

6). The shroud was installed (LMSC Personnel).

27. Final Operational Check (ESA) and Sterilization

a. The ESA Operational Checkout was performed April 18, 1962, using procedure No. P35R 317.01-2. No spacecraft problems were discovered. The transponder receiver AGC threshold was measured again at -137 dbm with Lunar Capsule S/N 13 and shroud on. This was within 1 dbm of the threshold measured with the same capsule on March 30, 1962.

b. Sterilization was completed April 18, 1962 with no difficulties reported.

c. A check was performed on the blockhouse equipment using the spacecraft simulator. The only problem was the failure of a battery charger timing circuit in the Power GSE. The circuit board was replaced.

28. PRECOUNTDOWN Checkout

This test was performed April 19, 1962, after squib firing assembly no-voltage checks were performed at the ESA and the spacecraft verified to be in SAFE condition to move to Complex 12. The spacecraft moved to the Complex at 0400 EST.

The only discrepancy noted during the precountdown was: (JPL Procedure 309.01):

a. Channels 5A0 and 4H8 (Nitrogen tank pressure transducer) intermittently read mid-band and was isolated to the transducer itself. The transducer was monitoring leakage from the mid-course motor Nitrogen pressure bottles, and did operate correctly during many periods. Since it did not detect a decrease in pressure but dropped out completely, indicating no leakage, it was waived as a mandatory telemetry measurement for the flight.

29. SIMULATED LAUNCH

The countdown took place April 20, 1962, starting at 0500 EST. A functional discrepancy still remained in Channel 4 and 5 measurements of the mid-course motor Nitrogen pressure. Channels 5A0 and 4H8 were intermittently in and out, finally remaining at mid-band after T-6 minutes.

Holds were called during the simulated launch as follows:

a. A 10-minute hold was called at T-40 to verify the GE Guidance Loop Check. The hold was extended for a total hold time of 27 minutes when GE suspected trouble with their pulse beacon.

b. A hold was called at T-30, duration 23 minutes, during which GE decided to continue the test with the known malfunction.

c. The final hold was called at T-5, duration 3-1/2 minutes, to establish LAUNCH PLAN 23D.

The remainder of the test proceeded without difficulty, and normal abort procedure was performed at T-18 seconds, recycling to T-5 minutes to de-lox and shut down. All spacecraft systems except as noted, were GREEN. A waiver was given by Deputy Program Director to fly the faulty Nitrogen pressure transducer on the mid-course motor.

Total operating time spent testing RA-4 Spacecraft at AMR was 122 hours.

IV. LAUNCH OPERATIONS (April 23, 1962)

A. The launch countdown proceeded normally, with HOLDS called at the following times:

1). Hold called at T-60 minutes, duration 88 minutes, to correct difficulties with the ATLAS umbilical plugs.

2). Hold called at T-40 minutes to re-run the GE Guidance loop data. Duration of this hold was 7 minutes.

3). Hold called at T-15 minutes, duration 8-1/2 minutes, to complete LOX tanking in the ATLAS.

4). Hold called at T-5 minutes, duration 6 minutes, to set up LAUNCH PLAN 23D.

5). Hold called at T-2 minutes 27 seconds to solve a GE Guidance problem. Count recycled to T-5 and LAUNCH PLAN 23H established. Duration of this hold was 9 minutes.

There were no holds called due to the spacecraft. The only spacecraft discrepancy noted was the Nitrogen pressure transducer in the mid-course motor which read intermittantly at mid-band. Channels 5A0 and 4H8 were intermittant during both the simulated launch and the launch countdown and were waived for the flight.

B. The Ranger RA-4/ATLAS 133D/AGENA 6004 vehicle was launched during the first launch countdown, meeting the first firing period, at 20h 50m 15.040s Zulu on April 23, 1962, from Complex 12 at the Atlantic Missile Range.

During the boost phase of the launch the ATLAS vehicle performed in the following manner:

Booster Engine Cutoff (BECO) - Nominal

Sustainer Engine Cutoff (SECO) - Nominal

Vernier Engine Cutoff (VECO) - Initiated by Timer.

AGENA performance was well within tolerances, and the following events were seen:

1. Spacecraft shroud ejection occurred at Launch + 296.91 sec (20:55:12Z).

2. Atlas/AGENA separation occurred at Launch + 299.95 sec. (20:55:15Z).

3. AGENA first burn occurred at Launch + 344.235 seconds (20:55:59Z).

4. AGENA 2nd burn ignition occurred at Launch + 743.160 seconds (21:02:48Z).

5. AGENA Spacecraft separation occurred at Launch + 998.160 seconds.

6. AGENA retromotor firing occurred at Launch + 1390 seconds (1 second off nominal.).

C. The AMR tracking and computer operation was good. The data from Ascension Island indicated a nearly standard trajectory at injection precise enough to make a Lunar intercept. The JPL Launch Checkout Station lost lock with the spacecraft transponder at Launch + 460 seconds with a signal of minus 135 dbm. Both the RF and telemetry trailers indicated nominal operation of all spacecraft functions to this time. However, between the loss of signal from the JPL Launch Checkout Station and acquisition by DSIF 1 at Launch + 1377.96 seconds (21:13:12Z). There was a loss of modulation on Channels 2, 3, 4, and B19 as well as a loss of Channel 1.

It was apparent that the telemetering commutator was not running, and addition, there did not appear to be any 400 cps signal to Channel 1. No blips were observed on Channel B-2 at the time the solar panels were to be extended nor at the time any of the subsequent CC&S commands were to be given. No Gamma-ray readouts were observed on Channel 8 after the time the CC&S was to have started them. At Launch + 234 minutes, Channel 1 locked on the 400 cps tone. Periodic variations in the received radio signal strength indicated that acquisition of the Sun had not been accomplished.

V. RA-4 SPACECRAFT FLIGHT CONFIGURATION (Serialization of Components)

The following was the RA-4 flight configuration as of April 23, 1962:

NOMENCLATURE	UNIT NO.	SERIAL NO.	NOMENCLATURE	UNIT NO.	SERIAL NO.
Basic Hex.	1A1	14	Jet Vane.	1A25	40
Solar Panel Support.	1A2	14	Jet Vane.	1A26	19
Solar Panel Support.	1A3	14	Jet Vane.	1A27	4
Solar Panel Support	1A4	14	Omni Adapter.	1A28	7
Solar Panel Support.	1A5	14	Transponder.	2A1	26
Hi-gain Ant Yoke Assey.	1A6	NA	RF Driver.	2A2	35-1
Earth Sensor Sun Shade.	1A7	13	RF Amp. (High-gain).	2A3	33-2
Vidicon Lens Cover.	1A8	4	Diplexer.	2A4	14
Solar Panel Actuator.	1A9	63	RF Amp. (Low-gain).	2A5	25-2
Solar Panel Actuator.	1A10	64	Ant. Monitor. (Hi-gain).	2A6	26
Case 1 (empty).	1A11	NA	Ant. Monitor. (Lo-gain).	2A7	26
Case 2 (empty).	1A12	NA	Antenna. (High-gain).	2A8	12
Case 3 (empty).	1A13	NA	Antenna. (Low-gain).	2A9	7
Case 4 (empty).	1A14	NA	Ant. Transfer Sw.	2A10	26
Case 5 (empty).	1A15	NA	Rotary Joint.	2A20	10
Case 6 (empty).	1A16	NA	Transponder Temp Trans.	2TT1	448
Vidicon Support.	1A17	NA	Command Detector.	3A1	10
Omni Boom.	1A18	9	Command Decoder.	3A2	7
Omni Boom Actuator.	1A19	7	Power Sw & Logic.	4A1	7
Omni Boom Clamp Assy.	1A20	6	Boost Reg.	4A2	6
G.R. Boom & Sphere Assy.	1A21	9	A/C Converter.	4A3	7
Thermal Shield.	1A23	NA	Communications Converter	4A4	9
Jet Vane.	1A24	31	Command Converter.	4A5	9

V. RA-4 SPACECRAFT FLIGHT CONFIGURATION (Cont'd)

NOMENCLATURE	UNIT NO.	SERIAL NO.	NOMENCLATURE	UNIT NO.	SERIAL NO.
CC&S Converter.	4A6	4	Accelerometer Integration	5A6	6
Data Encoder Converter.	4A7	7	Input Decoder.	5A7	6
Scientific Inverter.	4A8	7	Pulse Sequencer.	5A8	6
Solar Panel.	4A9	11	CC&S TR Unit.	5A9	6
Solar Panel.	4A10	12	VCO #1.	6A1	4
Power Sync Supply.	4A12	7	VCO # 2.	6A2	4
400 CPS 1 Phase Inverter	4A13	6	VCO # 3.	6A3	6
400 CPS 3 Phase Inverter.	4A14	7	Binary Oscillator.	6A4	4
Battery.	4A15	14	Commutator #1.	6A5	6
Solar Panel Evaluator.	4A16	2	Commutator #2.	6A6	3
Battery Temp Trans. (A)	4TT1	626	Commutator #3.	6A7	4
Boost Reg Temp Trans.	4TT3	823	Commutator #4.	6A8	4
A/C Converter Temp Trans.	4TT4	279	Signal Conditioner.	6A9	4
Battery Temp Trans. (B)	4TT6	*	DC Amp.	6A10	4
4A10 Temp Trans. (Front)	4TT7	570	Event Coder.	6A11	4
4A10 Temp Trans. (Rear)	4TT8	746	Temp Bridge #1.	6A12	6
4A9 Temp Trans. (Front)	4TT9	642	Temp Bridge #2.	6A13	4
4A9 Temp Trans. (Rear)	4TT10	643	Data Selector.	6A14	4
PS&L Temp Trans.	4TT11	824	Gyros.	7A1	8
Central Clock.	5A1	6	Gyro Elect.	7A2	8
Launch Counter.	5A2	6	Ant Drive Elect.	7A3	8
Maneuver Clock.	5A3	6	Switch Amp.	7A4	6
Maneuver Durations.	5A4	6	Autopilot Elect.	7A5	6
Maneuver Output.	5A5	5	Jet Valve. (A)	7A6	92

* Not used.

NOMENCLATURE	UNIT NO.	SERIAL NO.
Jet Valve. (B)	7A6	77
Jet Valve. (C)	7A6	63
Jet Valve. (A)	7A7	97
Jet Valve. (B)	7A7	75
Jet Valve. (C)	7A7	100
Ant Drive Motor	7A8	15
Earth Sensor.	7A9	38
Sun Sensor.	7A10	AYR
Sun Sensor.	7A11	APR
Sun Sensor.	7A12	AYL
Sun Sensor.	7A13	APL
Sun Senor.	7A14	4BY
Sun Sensor.	7A15	4BP
Jet Valve. (A)	7A16	99
Jet Valve. (B)	7A16	59
Jet Valve. (A)	7A17	70
Jet Valve. (B)	7A17	44
Nitrogen Tank Press Trans	7A18	2-1632
Accelerometer.	7A21	3
Nitrogen Press Bottle	7A22	1038/ KB-248
Nitrogen Press Bottle	7A23	1028/ KB-240
Nitrogen Press Bottle	7A24	1039/ KB-251
Nitrogen Press Regulator	7A25	3

NOMENCLATURE	UNIT NO.	SERIAL NO.
Nitrogen Tank Temp Trans.	7TT1	321
Earth Sensor Temp Trans.	7TT2	416
Sun Sensor Temp Trans.	7TT3	647
Sun Sensor Temp Trans.	7TT4	738
Sun Sensor Temp Trans.	7TT5	749
Sun Sensor Temp Trans.	7TT6	649
Gyro Temp. Trans.	7TT7	379
4A9 Unfold Squib.	8SQ1	669
4A9 Unfold Squib.	8SQ2	658
4A10 Unfold Squib.	8SQ3	617
4A10 Unfold Squib.	8SQ4	758
Omni Ant Deploy Squib.	8SQ5	631
G.R. Boom Deploy Squib.	8SQ7	695
Helium Valve Open Squib.	8SQ8	9101826
Helium Valve Shut Squib.	8SQ9	9101879
Fuel Valve Open Squib.	8SQ10	9101867
Fuel Valve Shut Squib.	8SQ11	9101953
Oxidizer Valve Open Squib.	8SQ12	9101947
Altimeter Deploy Bolt Cutters	8SQ13	800106
Vidicon Lens Uncover Squib.	8SQ14	607
4A9 Unfold Squib.	8SQ21	669
4A9 Unfold Squib.	8SQ22	658
4A10 Unfold Squib.	8SQ23	617
4A10 Unfold Squib.	8SQ24	758
Omni Ant Deploy Squib.	8SQ25	631

NOMENCLATURE	UNIT NO.	SERIAL NO.
G.R. Boom Deploy Squib.	8SQ27	695
Altimeter Deploy Bolt Cutters	8SQ33	800106
Vidicon Lens Uncover Squib.	8SQ34	607
Squib Firing Assy.	8A41	6
4A9 Unfold Sensor.	8A69	NA
4A10 Unfold Sensor.	8A70	NA
G.R. Boom Deploy Sensor.	8A71	NA
Omni Ant Deploy Sensor.	8A72	NA
Capsule Separation Sensor	8A73	RA-4-1
Altimeter Deploy Sensor	8A74	NA
Ring Harness	9W1	3
M.C.M. Ignition Harness	9W2	6
M.C.M. Harness	9W3	5
Vidicon Cbl.	9W4	10
Earth Sensor Cbl.	9W5	11
Squib Harness.	9W6/7	10
Case 2 To Case 5 Coax.	9W8	F-3
Case 2 To Rotary Joint Coax.	9W9	C-6
Rotary Joint to Hi-gain Ant. Coax.	9W10	B-7
Case 1 Harness. (CC&S)	9W11	14
Case 2 Harness.	9W12	8
Case 3 Harness.	9W13	7
Case 4 Harness.	9W14	11

NOMENCLATURE	UNIT NO.	SERIAL NO.
Case 5 Harness.	9W15	5
Case 6 Harness.	9W16	11
G.R. Boom Cbl.	9W17	10
Case 1 Harness. (Command)	9W18	10
M.C.M. Transducer Harness	9W19	5
G.R. #1 Harnes.	9W20	4
G.R. #2 Harness.	9W21	11
Omni Boom Squib Harness	9W22	9
NOTE: 9W23 thru 9W32 are mounted inside case 2, and are not serialized.		
G.R. #3 Harness	9W33	4
Case 5 to Omni Coax.	9W34	D-6
Fuel Valve.	10A1	9101999
Helium Valve.	10A2	9101734
+Y Yaw Actuator.	10A3	87A
-Y Yaw Actuator.	10A4	57A
+X Pitch Actuator.	10A5	81A
-X Pitch Actuator.	10A6	67A
Oxidizer Valve.	10A7	9101332
Fuel Tank Press Trans.	10A8	8506
Helium Tank Press Trans.	10A9	8512
Engine Wall Temp. Trans.	10TT1	31958
Fuel Tank Temp Trans.	10TT2	566
Helium Tank Temp Trans.	10TT3	581
-Y Yaw Actuator Temp Trans	10TT4	631

NOMENCLATURE	UNIT NO.	SERIAL NO.
+ Yaw Actuator Temp Trans	10TT5	635
Carrier Support Temp Trans	11TT1	446
Vidicon Assy.	21A1	4
Vidicon Elect.	21A2	4
Vidicon TR Unit.	21A3	4
Gamma Ray Detector	23A1	7
Detector Power Supply	23A2	3
Gamma Ray Decoder	23A3	105
Gamma Ray Memory	23A4	105
Gamma Ray Programmer	23A5	105
Gamma Ray Converter	23A6	105
P.H.A. TR Unit	23A7	105
Detector Temp Trans	23TT1	105
Radio Alt.	24A1	FP-2
Radio Alt Support	24A2	103
Radio Alt "J" Box	24A3	103
Thermal Switch	24A4	103
Retro Support	25A1	103
Retro Motor	25A2	203
Lunar Capsule	25A3	13
Spin Motor	25A4	315
Power Sequencer and Logic	25A6	FP-9
Heat Shield Retractors	25A7	NA
Bus Separation Clamp Assy	25A9	103
Payload Separation Clamp Assy.	25A9	NA
Radiation Shield	25A10	103
Scientific Commutator	29A1	4
Thermal Switch	29A2	L-330

VI LAUNCH COUNTDOWN LOG - TEST 821 AMR

TIME GMT	T-TIME	EVENT
1412	T -280	Picked up range count.
1452	240	JPL Communication check.
1502	230	JPL Communication reports all circuits green with exception of TFV.
1503	231	First motion timer and light check (internal) okay'.
	212	TE reports malfunction in LCS - not power back to Blockhouse.
	205	Broken switch in blockhouse panel. DC power switch on monitor control panel in blockhouse faulty - replaced. JPL countdown started. Equipment replacement.
	200	Spacecraft power ON.
	187	Station A (DSIF) - 1 TTY to each station,all TDY to Goldstone
	185	Atlas hydraulic fluid does not meet spec; being replaced. All other vehicle items GO.
	175	SRO reports solar activity causing ionospheric storm which is disrupting communication.
		Station 91 - okay
		Station 12 - Intermittent - probably get worse.
	154	Weather Report:

	F-1	T-12H	T-6H
Bending moment	37%	31%	40%
Usable control	28%	20%	31%
Total effect	60%	57%	62%

VI LAUNCH COUNTDOWN LOG (Cont'd)

TIME		EVENT
GMT	T-TIME	
	T - 146	UDMH tanking delayed because of faulty air-conditioner on vehicle. A/C being replaced - will probably work into built-in hold.
	144	GE loop tests delayed because of telemetry problem - should start shortly.
		Station 92.16 CNY Range digital system CNY, no spare for faulty part, trying to repair.
		B-57 standing by to fly spare down if procured in time. No raw real time data to 7090 or JPL. DTS-CNY
	135	GE loop tests GO.
	127	JPL Communication reports they are receiving RY test tape from TFV - looks good.
	120	Nitrogen pressure transducer on mid-course motor system intermittent.
	115	DSIF READY
	113	Permission given for UDMH tanking start.
	110	Will not stop UDMH tanking at 10%; will go to 100%.
	97	AGENA UDMH 100% tanking complete.
	90	Disconnect problem - tower still up.
		a. 960.036736 MC at 1716Z
		b. 890.038800 MC at 1720Z
		c. 960.041805 MC at 1723
		d. 85°F at 1711Z

VI LAUNCH COUNTDOWN LOG (Cont'd)

TIME		EVENT
GMT	T-TIME	
	T -73	Agena umbilical disconnect problem cleared - preparing for gantry removal.
	60	Spacecraft GREEN all areas.
		Lunar Capsule frequency -960.239340 MC
1754	60	Start 70 minute build-in hold
1805	60	Station 92.16 GO
1807		TFV-TTY garbled
	60	Atlas quick disconnect knocked out (2 umbilicals out)
1825		Atlas umbilicals back in
1832		Blockhouse reports pressurization umbilical out. Helium emergency pressure activated. Umbilical now back in.
		Case 2 temperature - 88°F at 1840Z
1859		Station reports CCS & DSIF are GREEN.
1903		Blockhouse hold extended approximately 10 to 15 minutes.
1919		Pick up count at T-60 minutes
		Spacecraft - GO
		DSIF - GO
		CCF - GO
		AMR Range - GO
		Vehicle - GO
	54	Station 92.16 DTS - CNY Az. - el. okay Ranging out.

VI LAUNCH COUNTDOWN LOG (Cont'd)

TIME		EVENT
GMT	T-TIME	
	T -50	LN_2 leak - ATLAS
	45	Both Leased lines out.
	43	No GO loop test - no steering command.
		Hold at T-40
		a. 960.036299 MC at 1924Z
		b. 890.039100 MC at 1918Z
		c. 960.042208 MC at 1921Z
		d. 890.037600 MC at 1927Z
		e. +.06v at 1930Z
		f. 89°F at 1925Z
	39:30	Station 92 GREEN
	38	GE guidance - GO
	38	2-1/2 hour weather report:
		45% - bending moment
		36% - usable control
		65% - total effect
	31	LOX TANKING IN PROCESS
	30	Station A - GO
		Station 92.16 - Slew check - okay
		Range information intermittent; however, if it looks okay to 7090.
2010		T-15 and holding for completion of LOX tanking.
2018		Picked up at T-15 minutes.

VI LAUNCH COUNTDOWN LOG (Cont'd)

TIME		EVENT
GMT	T-TIME	
	T - 12	Temperature Case II at 2015 - 90°F. Rate 4-9 Sync end, 2008:30Z Launch Plan 23 Golf
2028		Hold at T-5 minutes.
		CC&S and DSIF GREEN
2034		Pick up at T-5 minutes.
2036:30		Hold-GE guidance - recycle to T-5 shakey interlock switch on GE ground instrumentation.
		Procedural problem
		Launch Plan 23-Hotel (AZ = 100.4°)
		Pick up at T-5 minutes.
		L + 470s JPL - RFT lost lock (approx.)
2113:50		Station 1 has 1-way lock.
2128		1st batch of orbital elements, only computed data that has been sent out.
2129:08		Station 1 has 2-way lock.
2133		RFT - dropout at booster separation but did not lose lock, everything looks good.
2138		JPL CC receiving computed data and storing it here (look angles).
2205		Message 228 (look angles) last message sent.
2210		Johannesburg - varying 14 db over 4 min. (average - 104 dbm) all channels in lock. No sync on B-19: no commutation.

VI LAUNCH COUNTDOWN LOG (Cont'd)

TIME GMT	TIME T-TIME	EVENT
2219		Spacecraft frequencies:
		Channel 1 - 351 cps
		2 - 516
		3 - 720
		4 - 996
		5 - 1699
		8 - 3118
		B2 - 352
		B19 - 2101
		B20 - 2301
2222		Able reports Station 4 acquired one-way lock at 22:20:10Z - intermittent signal.
2226		7090 has ceased data transmission.
2237		7090 lines released (JPL---➤ SRO) DSIF - 4 acquired capsule at 2242Z, strength -153 dbm; sub-carrier at 559 cps.
2307		DSIF - 5 dropped lock
2311		DSIF - 5 out-of-lock
2314:18		DSIF - 5 back-in lock
2340		DSIF 1, 2-way lock
2344		4-1/2 min. -11 db Spacecraft signal
		16° below equator } Lunar
		153° 1ft } Impact
		63° wrap around } Estimate

VI LAUNCH COUNTDOWN LOG (Cont'd)

TIME		EVENT
GMT	T-TIME	
2344 (Cont'd)		Flight time - approximately 64 hours. Will try RTC-3 from South Africa at approximately 0007Z 4/24. If Mid-course maneuver is sent, will send from Goldstone.
23:50:30		Woomera lost track
2355		JPL countdown conductor (AE) checking out (equipment left ON.).
0007		DSIF - 1 transmitter off.
0008		Woomera securing.
0009		DSIF-5 acquired 2-way lock - 0007:54Z
00010		Station 1-pseudo 2-way at 0009:28Z
		First motion clock - +12,500.0 at 0018.36.5Z
		Launch +12,600.0 sec. at 0020:17Z

Table 3. SEQUENCE OF LAUNCH EVENTS.

TO: Jet Lab Computer

BT:

RATE 4-9 SYNC END 20 HR. 08 MIN. 30 SEC.

LIFTOFF: 20 HRS. 50 MIN. 15.040 + SEC.

	MARK #				NOMINAL	ACTUAL
	1	L+	2052	32.67	138	137.63
Tel 2	2	L+	2052	35.85	141	140.81
↓						
SRO	3	L+	2054	49.55	274	274.51
↓						
JPL	4	L+	2055	10.2	291	295.91
	5	L+	2055	11.95	292	296.91
	6	L+	2055	14.99	295	299.95
	7	L+	2055	59.275	342	244.235
Sta 91	8		2058	33.17	496	498.130
↓						
SRO	9		2102	48.2	754	753.160
↓						
JPL	10	L+	2104	14.6	842	839.460
	11	L+	2106	47.3	995	992.260
	12	L+	2106	53.2	999	998.160
	13	L+	2113	25.040	1391	1390.00

ET

DTG 515 - 555

ch. 2

PLS ACK